PATENT ABSTRACTS OF JAPAN

(11)Publication number : **10-125471**
(43)Date of publication of application : **15.05.1998**

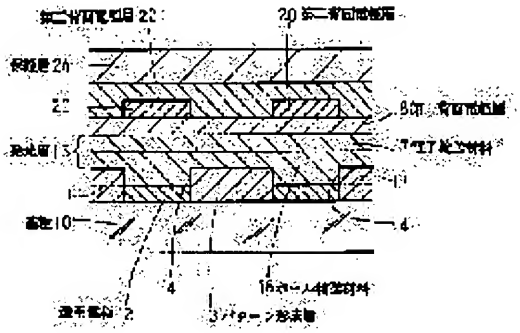
(51)Int.Cl. H05B 33/26
H05B 33/10

(21)Application number : **08-298254**
(22)Date of filing : **21.10.1996**

(71)Applicant : **HOKURIKU ELECTRIC IND CO LTD**
(72)Inventor : **WAKABAYASHI MORIMITSU**
TANPO TETSUYA
FUKUMOTO SHIGERU

(54) EL ELEMENT AND MANUFACTURE THEREOF

(57)Abstract:
PROBLEM TO BE SOLVED: To enable uniform luminescence of a prescribed pattern or the like by employing a simple constitution.
SOLUTION: A transference electrode 12 made of a transference electrode material such as ITO, etc., is formed in a prescribed pattern on a transparent substrate 10 like glass, etc., and a hole transport material 16 and a electron transport material 17 and a luminescent layer 15 made of organic EL material by using other luminescent material are laminated on the upper surface of the electrode 12. The first back surface electrode layer 18 having relatively high purity is laminated in a thin layer on the surface of the luminescent layer 15 and further on its surface, the second back surface electrode layer 20 having relatively low purity but high electron donating property is laminated facing to the abovementioned pattern, and on the surface of this second back surface electrode layer 20, the third back surface electrode layer 22 having relatively high purity is formed all over in a layer thicker than the first back surface electrode layer 18.



LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]
[Patent number]
[Date of registration]
[Number of appeal against examiner's decision of rejection]
[Date of requesting appeal against examiner's decision of rejection]
[Date of extinction of right]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] This invention relates to the EL element used for the display of the flat-surface light source, or a display and other predetermined patterns, and its manufacture method.
[0002]
[Description of the Prior Art] A conventional, for example, organic, EL (electroluminescence) element forms the transparent electrode of the ITO film of a translucency in a glass substrate, prepares hole transportation material, such as a triphenylamine derivative (TPD), in the upper surface, and is carrying out the laminating of the electronic transportation material, such as an aluminum chelate complex (Alq3) which is luminescent material, on it. And back plates, such as aluminum, Li, Ag, Mg, and In, are formed in the upper surface. Predetermined voltage is impressed between a transparent electrode and a back plate, and this organic EL element produces luminescence. And on the occasion of manufacture of this organic EL element, an electrode material and EL material are formed with vacuum deposition on a glass substrate.
[0003]
[Problem(s) to be Solved by the Invention] the liquid crystal device which an organic EL element is an element for which current flows here, and is controlled by electric field -- differing -- a luminescence position -- the conductor -- it was what current value differs, the amounts of luminescence differ, and dispersion produces in a luminosity from the resistance of a path Therefore, the resistance of the conductor which reaches a luminescence part has the desirable one as low as possible and more nearly equal. However, conventionally, field luminescence of an EL element is common and it had only X, cross point luminescence by Y lines, and the luminescence control by the dot drive circuit of a transistor as a thing made to emit light partially. Therefore, the structure of EL light emitting device made to emit light for every predetermined pattern is not proposed.
[0004] this invention offers the EL element which it was made in view of the above-mentioned Prior art, is easy composition, and enables uniform luminescence of a predetermined pattern etc., and its manufacture method -- it aims at things
[0005]
[Means for Solving the Problem] This invention is formed on transparent substrates, such as glass, at a pattern predetermined in the transparent electrode by transparent electrode materials, such as ITO. The laminating of the luminous layer which becomes the upper surface of the above-mentioned transparent electrode from organic EL material by hole transportation material and electronic transportation material and other luminescent material is carried out. Furthermore, the laminating of the first back plate layer of a high grade is relatively carried out to the front face of the above-mentioned luminous layer thinly. It is the EL element in which the laminating of the electron-donative high second back plate layer was carried out corresponding

to the above-mentioned pattern although purity was still more relatively [front face / the] low, and the third back plate layer of a high grade was formed relatively / front face / of this second back plate layer] more thickly than the above-mentioned first back plate layer. Furthermore, as for portions other than the predetermined pattern of the above-mentioned transparent electrode, an insulator or conductivity is covered by low material. Moreover, portions other than the predetermined pattern of the above-mentioned transparent electrode are covered by the material of the color near a color when black, the dark color, the luminescent color displayed with the above-mentioned pattern and the color which produces high contrast, or the above-mentioned luminous layer is not emitting light.

[0006] Moreover, the transparent electrode according [this invention] to transparent electrode materials, such as ITO, to a transparent substrates top, such as glass, is formed on one side. The laminating of the luminous layer which becomes the upper surface of the above-mentioned transparent electrode from organic EL material by hole transportation material and electronic transportation material and other luminescent material is carried out. Furthermore, the laminating of the first back plate layer of a high grade is relatively carried out to the front face of the above-mentioned luminous layer by the thin predetermined pattern. Although purity is still more relatively [front face / the] low, corresponding to the above-mentioned predetermined pattern, the laminating of the electron-donative high second back plate layer is carried out. It is the EL element in which the third back plate layer of a high grade was formed relatively [front face / of this second back plate layer] corresponding to the above-mentioned predetermined pattern thicker than the above-mentioned first back plate layer. The above-mentioned predetermined pattern separates each above-mentioned back plate electrically mutually, and it is formed. Furthermore, an insulator or conductivity is covered for portions other than the portion corresponding to the above-mentioned predetermined pattern in the above-mentioned transparent electrode by low material. Moreover, the above-mentioned transparent electrode is covered by the material of the color near a color when the color or the above-mentioned luminous layer which portions other than the portion corresponding to the above-mentioned predetermined pattern make produce black, the dark color or the luminescent color displayed with the above-mentioned pattern, and high contrast is not emitting light.

[0007] This invention on transparent substrates, such as glass, moreover, by vacuum deposition, sputtering, and other vacuum thin film coating technologies Form the transparent electrode of transparent electrode materials, such as ITO, and portions other than the portion corresponding to a predetermined pattern on the front face of the above-mentioned transparent electrode An insulator or conductivity covers by the above-mentioned vacuum thin film coating technology with low material. The laminating of the luminous layer of hole transportation material and electronic transportation material is carried out to the upper surface by the above-mentioned vacuum thin film coating technology. Furthermore, the laminating of the first back plate layer of a high grade is relatively carried out to the front face of the above-mentioned luminous layer thinly by the above-mentioned vacuum thin film coating technology. Although purity is still more relatively [front face / the] low, corresponding to the above-mentioned predetermined pattern, the laminating of the electron-donative high second back plate layer is carried out by the above-mentioned vacuum thin film coating technology. It is the manufacture method of the EL element which carries out the laminating of the third back plate layer of a high grade by the above-mentioned vacuum thin film coating technology relatively [front face / of this second back plate layer] more thickly than the above-mentioned first back plate layer. Formation of each class by the above-mentioned vacuum thin film coating technology is performed at a series of processes, and it is formed using the mask of the above-mentioned predetermined pattern predetermined configuration.

[0008]

[Embodiments of the Invention] Hereafter, the gestalt of implementation of this invention is explained based on a drawing. Drawing 1 and drawing 2 are what shows the first operation gestalt of the EL element of this invention. the EL element of this operation gestalt So that it may be an organic thin film EL element and may illustrate on the front face of the transparent substrates 10, such as glass, a transparent resin, and a quartz the conductor which is formed in predetermined patterns, such as a segment as the transparent electrode 12 which are transparent electrodes, such as ITO, shows to drawing 2 , and connects with the pattern further -- the section 11 is formed with almost equal configuration or resistance for every segment The pattern formation layers 13, such as insulating materials, such as black carbon with which the bore pattern 14 was formed corresponding to this transparent electrode 12, black, or a dark-colored resin, are formed in the front-face side of a transparent electrode 12. When the pattern formation layer 13 is carbon, a laminating is carried out so that it may become the high resistance of the grade which does not influence luminescence.
[0009] On the pattern formation layer 13, the luminous layer 15 by EL material is formed. A luminous layer 15 has a triphenylamine derivative (TPD), a hydrazone derivative, an arylamine derivative, etc. as a hole transportation material 16 among parent material. Moreover, as an electronic transportation material 17, an aluminum chelate complex (Alq3), a distyrylbiphenyl derivative (DPVBi), an OKISA diazole derivative, a screw CHIRIRU anthracene derivative, a benzo oxazole thiophene derivative, perylenes, and thiazoles are used. The ratio of the above-mentioned hole transportation material 16 and the electronic transportation material 17 can be suitably changed in 10:90 or 90:10, and may add the luminescent material of further others.
[0010] And the first back plate layer 18 by aluminum of 99.999% or more of purity is formed in the thickness which is about 200A, and is formed in the front face of the electronic transportation material 17 of a luminous layer 15 by the thickness of about 200A at the configuration corresponding to the above-mentioned predetermined pattern in the second back plate layer 20 of the aluminum-Li alloy of about 99% of purity which contains Li about 0.01 to 0.05% on the upper surface. Furthermore, on the second back plate layer 20, the third back plate layer 22 by aluminum of 99.999% or more of purity is formed at the thickness which is about 500A. In addition, the thickness of the second and the third back plate layers 18, 20, and 22 can be set up suitably, relatively, is thinner than the third back plate layer 22 in the second back plate layers 18 and 20, and should just make the third back plate layers 18 and 22 what has high purity for a start. Furthermore, for a start, ****** proper change of thickness of 100 to about 1000A is respectively possible for the second and the third back plate layers 18, 20, and 22, and electronic supply nature should just make them more preferably the thickness of 200 to about 500A respectively as a range which a dark spot cannot generate easily well.
[0011] The laminating of the protective layer 24 is carried out to the upper surface of the third back plate layer 22. A protective layer 24 is formed of metal thin films, such as Ag and aluminum, and intercepts each back plate layers 18, 20, and 22 and a luminous layer 15 from the open air. Furthermore, resins, such as a phenol and epoxy, and the protective layer which is not illustrated by the conductive paint are formed.
[0012] The manufacture method of the organic thin film EL element of this operation gestalt forms the transparent electrode 12 by ITO etc. on a substrate 10 first by the thin film coating technology in the vacuum of vacuum evaporationo, flash plate vacuum evaporationo, sputtering, and others. this time -- a predetermined pattern and a conductor -- the section 11 is formed by mask vacuum evaporationo In addition, you may form a predetermined pattern and the predetermined fuselage section 11 by etching. Next, the pattern formation layer 13 which has the bore pattern 14 is formed by the arbitrary methods of the above-mentioned vacuum thin film coating technologies. The bore pattern 14 is also formed by mask vacuum evaporationo.
[0013] Next, the luminous layer 15 of EL material is formed one by one by the arbitrary

methods of the above-mentioned thin film coating technology in order of the hole transportation material 16 and the electronic transportation material 17. The first back plate layer 18 is formed [thickness predetermined by the above-mentioned vacuum thin film coating technologies, such as vacuum evaporationo,] in the front face of a luminous layer 15 at the whole surface. Next, the second back plate layer 20 is formed in a predetermined pattern configuration and predetermined thickness by mask vacuum evaporationo. Next, the third back plate layer 22 is similarly formed in the front face of the second back plate layer 20. And a protective layer 24 is formed. A protective layer 24 forms aluminum and Ag similarly by the above-mentioned vacuum thin film coating technology.

[0014] A degree of vacuum is 6x10-6Torr, and, in the case of EL material, forms vacuum evaporationo conditions by the evaporation rate of 50A/sec here. A flash plate vacuum deposition drops the source of vacuum evaporationo which heated preferably 300-600 degrees C of organic EL material beforehand mixed by the predetermined ratio at 400-500 degrees C, and evaporates organic EL material at a stretch. Moreover, the organic EL material is held into a container, the container is heated quickly, and vacuum evaporationo may be carried out at a stretch.

[0015] the EL element of this operation gestalt -- a transparent electrode 12 -- **** -- a conductor -- since the section 11 is formed so that it may become almost equal resistance for every pattern, there is no unevenness in the luminosity of the luminous layer 15 for every pattern, and uniform luminescence is enabled Furthermore, a certain amount of luminous efficiency is secured, pressing down generating of a dark spot, since the first back plate layer 18 of aluminum with purity high as a back plate was formed, purity formed the high second back plate layer 20 of an AL-Li alloy also with high electronic supply nature, there is no impurity and electronic supply nature also formed the to some extent high back plate further.

[0016] Next, the EL element of the second operation gestalt of this invention is explained based on drawing 3 and drawing 4 . Here, the same member as the above-mentioned operation gestalt attaches the same sign, and omits explanation. So that the EL element of this operation gestalt may be an organic thin film EL element and it may illustrate As it is formed in the front face of the transparent substrates 10, such as glass, a transparent resin, and a quartz, at the whole surface as the transparent electrode 12 which are transparent electrodes, such as ITO, shows drawing 3 , and further shown in drawing 4 The pattern formation layers 13, such as insulating materials, such as black carbon with which the bore pattern 14 of the bore configuration corresponding to the pattern of a predetermined display was formed, black, or a dark-colored resin, are formed.

[0017] On the pattern formation layer 13, the luminous layer 15 by EL material is formed like the above-mentioned operation gestalt. And the first back plate layer 18 of aluminum of 99.999% or more of purity is formed in the front face of the electronic transportation material 17 of a luminous layer 15 by the thickness of about 200A at the configuration corresponding to the above-mentioned predetermined pattern. The second back plate layer 20 of the aluminum-Li alloy of about 99% of purity which contains Li about 0.01 to 0.05% is formed in the upper surface by the thickness of about 200A at the configuration corresponding to the above-mentioned predetermined pattern. Furthermore, on the second back plate layer 20, the third back plate layer 22 by aluminum of 99.999% or more of purity is formed by the thickness of about 500A at the configuration corresponding to the above-mentioned predetermined pattern. In addition, like the above-mentioned operation gestalt, ****** proper change of 100 to about 1000A is respectively possible for thickness, and electronic supply nature should just make more preferably thickness of the second and the third back plate layers 18, 20, and 22 respectively the thickness of 200 to about 500A for a start as a range which a dark spot cannot generate easily well.

[0018] The laminating of the insulating protective layer 24 is carried out to the upper surface of

the third back plate layer 22. the conductor to which the bore 25 was formed and, as for the protective layer 24, was connected with the front face of a protective layer 24 following a bore 25 and this -- the section 26 is formed The fuselage section 26 is formed of metal thin films, such as a conductive paint, and Ag, aluminum. Furthermore, the protective layer which is not illustrated with insulators, such as resins, such as a phenol and epoxy, is formed.

[0019] The manufacture method of the organic thin film EL element of this operation gestalt forms the transparent electrode 12 by ITO etc. on a substrate 10 first at the whole surface by the thin film coating technology in the vacuum of vacuum evaporationo, flash plate vacuum evaporationo, sputtering, and others. Next, the pattern formation layer 13 which has the bore pattern 14 is formed by the arbitrary methods of the above-mentioned vacuum thin film coating technologies. The bore pattern 14 is formed by mask vacuum evaporationo.

[0020] Next, the luminous layer 15 of EL material is formed one by one by the arbitrary methods of the above-mentioned thin film coating technology in order of the hole transportation material 16 and the electronic transportation material 17. The first back plate layer 18 is formed in the front face of a luminous layer 15 at a predetermined pattern configuration and predetermined thickness by the mask vacuum evaporationo of the above-mentioned vacuum thin film coating technologies, such as vacuum evaporationo. Next, the second back plate layer 20 is formed in a predetermined pattern configuration and predetermined thickness by mask vacuum evaporationo. Furthermore, the third back plate layer 22 is similarly formed in the front face of the second back plate layer 20. And a protective layer 24 is formed. A protective layer 24 forms aluminum and Ag one by one by the above-mentioned vacuum thin film coating technology.

[0021] In addition, Ag and In which a high grade is obtained in addition to aluminum of a high grade, and do not have a bad influence on a luminous layer are sufficient as the third back plate layer for a start [of the EL element of this invention]. Moreover, the second back plate layer can change the component ratio of an Ai-Li alloy suitably, and alloys, such as other Mg, and a high metallic-material simple substance electron-donative in addition to this are sufficient as it. Furthermore, efficiency can be further gathered by keeping temperature at about 100 degrees C after forming the second back plate layer, and promoting diffusion. Moreover, although EL material also carried out the laminating of hole transportation material and the electronic transportation material, it is selectable things, such as what mixed and deposited others and these, and a thing containing other luminescent material, suitably, and its luminescent color is also arbitrarily selectable.

[0022]

[Effect of the Invention] The EL element and its manufacture method of this invention can abolish the luminescence unevenness of a predetermined luminescence pattern portion, and can make luminous efficiency high.

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

TECHNICAL FIELD

[The technical field to which invention belongs] This invention relates to the EL element used for the display of the flat-surface light source, or a display and other predetermined patterns, and its manufacture method.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the cross section of the EL element of the first operation gestalt of this invention.
[Drawing 2] It is the plan of the EL element of this first operation gestalt.
[Drawing 3] It is the cross section of the EL element of the second operation gestalt of this invention.
[Drawing 4] It is the plan of the EL element of this second operation gestalt.
[Description of Notations]
10 Substrate
12 Transparent Electrode
13 Pattern Formation Layer
15 Luminous Layer
16 Hole Transportation Material
17 Electronic Transportation Material
18 First Back Plate Layer
20 Second Back Plate Layer
22 Third Back Plate Layer
24 Protective Layer

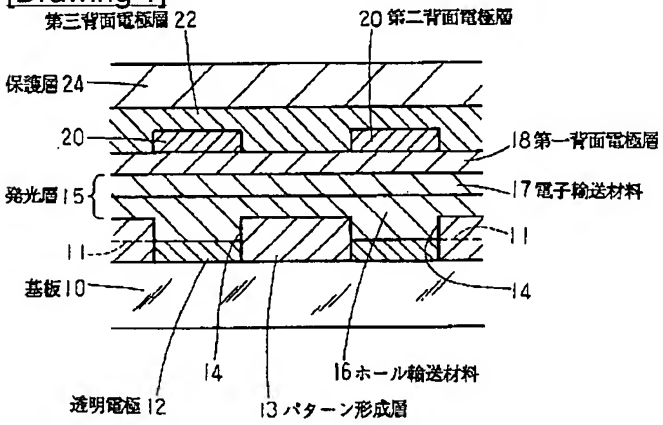
[Translation done.]

* NOTICES *

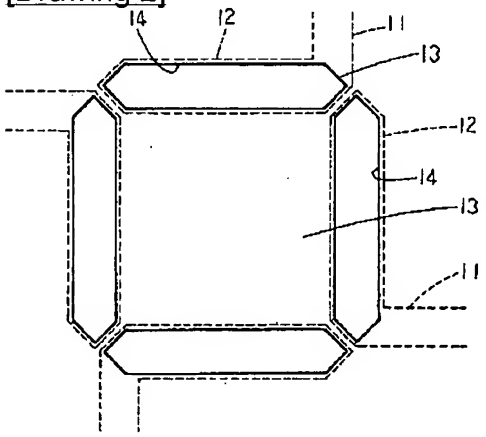
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

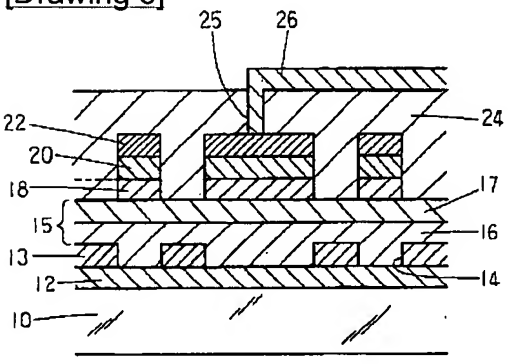
[Drawing 1]



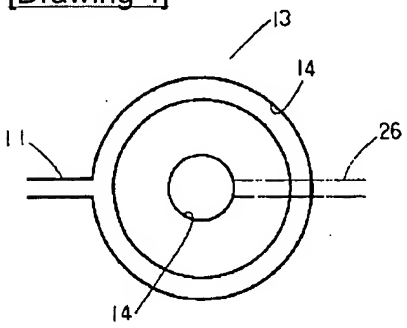
[Drawing 2]



[Drawing 3]



[Drawing 4]



[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] The transparent electrode by the transparent electrode material is formed on a transparent substrate at a predetermined pattern. The laminating of the luminous layer is carried out to the upper surface of the above-mentioned transparent electrode. further on the front face of the above-mentioned luminous layer The laminating of the first back plate layer of a high grade is carried out relatively, and although purity is still more relatively [front face / the] low, corresponding to the above-mentioned pattern, the laminating of the electron-donative high second back plate layer is carried out. The EL element in which the third back plate layer of a high grade was formed relatively [front face / of this second back plate layer] more thickly than the above-mentioned first back plate layer.
[Claim 2] Portions other than the predetermined pattern of the above-mentioned transparent electrode are EL elements according to claim 1 an insulator or whose conductivity is what is covered by low material.
[Claim 3] Portions other than the predetermined pattern of the above-mentioned transparent electrode are EL elements according to claim 1 which are what is covered by the material of the color near a color when black, the dark color, the luminescent color displayed with the above-mentioned pattern and the color which produces high contrast, or the above-mentioned luminous layer is not emitting light. .
[Claim 4] The transparent electrode by the transparent electrode material is formed on a transparent substrate at the whole surface, and the laminating of the luminous layer is carried out to the upper surface of the above-mentioned transparent electrode. Furthermore, the laminating of the first back plate layer of a high grade is relatively carried out to the front face of the above-mentioned luminous layer by the thin predetermined pattern. The EL element in which the laminating of the electron-donative high second back plate layer was carried out corresponding to the above-mentioned predetermined pattern although purity was still more relatively [front face / the] low, and the third back plate layer of a high grade was formed relatively / front face / of this second back plate layer] corresponding to the above-mentioned predetermined pattern thicker than the above-mentioned first back plate layer.
[Claim 5] Each above-mentioned back plate is an EL element according to claim 4 whose above-mentioned predetermined pattern is what is formed by dissociating electrically mutually.
[Claim 6] The above-mentioned transparent electrode is an EL element according to claim 4 whose portions other than the portion corresponding to the above-mentioned predetermined pattern are those by which an insulator or conductivity is covered by low material.
[Claim 7] The above-mentioned transparent electrode is an EL element according to claim 4 whose portions other than the portion corresponding to the above-mentioned predetermined pattern are what is covered by the material of the color near a color when black, the dark color, the luminescent color displayed with the above-mentioned pattern and the color which produces high contrast, or the above-mentioned luminous layer is not emitting light.

[Claim 8] The above-mentioned EL material is an EL element according to claim 1 or 4 which is organic EL material.
[Claim 9] On a transparent substrate, the transparent electrode of a transparent electrode material is formed by the vacuum thin film coating technology. An insulator or conductivity covers portions other than the portion corresponding to a predetermined pattern by the above-mentioned vacuum thin film coating technology on the front face of the above-mentioned transparent electrode with low material. The laminating of the luminous layer is carried out to the upper surface by the above-mentioned vacuum thin film coating technology. further on the front face of the above-mentioned luminous layer The laminating of the first back plate layer of a high grade is relatively carried out by the above-mentioned vacuum thin film coating technology. Although purity is still more relatively [front face / the] low, corresponding to the above-mentioned predetermined pattern, the laminating of the electron-donative high second back plate layer is carried out by the above-mentioned vacuum thin film coating technology. The manufacture method of the EL element which carries out the laminating of the third back plate layer of a high grade by the above-mentioned vacuum thin film coating technology relatively [front face / of this second back plate layer] more thickly than the above-mentioned first back plate layer.